INDUCTIVE

PSYCHOLOGY,

AN INTRODUCTION TO THE

Study of Mental Phenomena,

PREPARED FOR THE FIRST TERM'S WORK IN PSYCHOLOGY IN THE STATE NORMAL SCHOOL AT WINONA, MINN.

— BY —

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PREFACE.

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PREFACE.

In no progressive school are the natural sciences now taught without the use of plants, animals, apparatus and experiments. It is believed that the abstract and deductive study of those subjects fails in giving students the real knowledge and power that may be gained by concrete and inductive study. This little volume is prepared in the belief that the same thing is true in an even greater degree in the study of psychology. The study of abstract psychology and of the thoroughly dried specimens of mental phenomena given for illustration by psychologists lead the pupil to accept on faith classifications, principles and laws that he can neither observe, verify, or apply, and not only fails to give him the knowledge and power he should gain from the study, but is often useless and even worse than useless. To gain real knowledge and power, the pupil must observe and analyze the actual processes of his own mind and those of others, instead of taking what the author tells him about imaginary mental

processes, and he must be led to observe, judge, and think for himself. The teacher, if he is to make any practical use of psychology whatever in his profession, must study it in the concrete.

It is now generally recognized that expression is an important factor in making acquisitions clear, precise and permanent. In no other study is written expression so helpful and even absolutely necessary as in psychology, hence the results of the study of every topic should always be expressed in writing by the pupil.

This little volume does not claim to be a complete or a strictly scientific treatise, upon the intellectual powers, but it does aim to develop the real psychological knowledge and power necessary to pursue the subject understandingly either in books or in daily life and in the school room. The last chapter is nothing but an *outline*. From one to two weeks can profitably be spent upon it and at the close the students will have arrived at all of the *fundamental* principles of mental development.

The work is prepared specially for use in the author's own classes, but should other teachers of psychology and teachers' reading circles find themselves in accord with the ideas set forth in this preface, and impressed with the belief that they are partially realized in the use of this book, it will be revised with special reference to thier needs.

E. A. K.

Winona, Minn., June 15, 1893.

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CHAPTER I.

INTRODUCTION.

Definition and Scope of Psychology. Name five different subjects of study and state what kind of facts each one deals with. Name five different occupations and state what kind of acts are performed and materials dealt with. What is a science? Consult a dictionary and compare the difinition with what you know of the use of the word. Name four sciences and state what kind of things each one deals with.

Just as other sciences are concerned with a certain order of facts, so is Psychology. In one respect its scope is broader than that of any other science, for it treats of the mind, by which all subjects are studied, all industries carried on and all sciences developed. Name specifically, then, some of the facts with which this science deals. Psychology must classify all of these facts and determine the laws that control all thinking, feeling and willing.

METHOD.

Since we are to study this science we must inquire first how it is to be studied. In other sciences we observe, classify, experiment and infer, and in this we must do the same. There are difficulties in the way, however. When studying botany I may observe the half dozen plants in the window and classify them. I may experiment upon them by placing one in the shade and leaving another without water. One fades and the other dries up, and I infer that the others would do the same under like circumstances. You or any one else can observe the same plants, decide whether or not my classification is correct, repeat my experiments and judge for yourself as to the correctness of my inferences. Let us now make a psychological study. When I looked at the plants certain thoughts came to me, feelings were aroused and certain resolutions made. I noted them and was, perhaps, surprised at the number of thoughts, the intensity of the feelings, and the strength of the resolutions. At another time I do the same thing with a group of plants, note my thoughts, feelings and resolutions, compare them with those experienced before and, perhaps, reach certain conclusions. It was possible for you to make the

same botanical observations and experiments that I made, but can you make the same psychological observations and experiments? Is it possible for you to observe what my thoughts and feelings were when I looked at the plants? Notice what thoughts and feeling are passing through your mind as you look at this book. Can any one else observe them? Do you know what thoughts are passing through the mind of any one else in the room?

Are we warranted in saying that Psychology differs from other sciences in that its facts cannot be *directly* observed by but one individual, while those of other sciences can be observed by any number of individuals? Give illustrations and reasons in favor of your view. Would this be an advantage or a disadvantage?

Inferential Observations—How Made. If we cannot observe what is going on in the mind of another, we can infer to some extent. Leaving out of account what they may have said, give specific examples of how you have inferred the thoughts, feelings or determinations of others, stating upon what facts your inferences were based (tone of voice, change in color, movement of hand or of facial muscles, etc.)

Possibility of these Inferences. How is it that we infer that a companion is experiencing a feeling of pleasure when we see a peculiar movement of the lips or brightness in the eyes? or that a child understands our explanations when we see nothing but the movements of the muscles of the face, which we describe as the lighting up of his countenance? If we had never experienced a feeling of pleasure, and smiled, could we make the first inference? Can we infer anything that is passing in the mind of another except something similar to what we have experienced? Try to find some instances, but analyze them very closely before accepting them.

Probability of Our Inferences. What reason have we for believing that other people have thoughts and feelings like our own when they act as we do? Do we *know* that they have any thoughts and feelings at all, any more than other moving things, as the clock on the wall, or the engine on the track? We all believe that they have and now let us see if we can find a basis for that belief.

Notice the variations in the belief in different cases. Can you understand the thoughts and feelings of a cannibal or an Indian as well as you can those of a man of your own race and state of

civilization? of a murderer and thief as well as you can one of your own disposition ? of an artist or scientist as well as one of your own ability and culture ? of an infant or aged person as well as one of your own age? In all of these cases the bodily form, the nervous system and all the means of expressing thought and feeling are nearly the same, but the surroundings, the state of development and the history are different.

Again, we believe that animals have thoughts and feelings, and we think that we can interpret, though with less certainty than those of men, those of the higher mammals, as the horse, dog or monkey, and in a less measure those of birds, such as the crow, parrot, hen. The first have forms, nervous systems and means of expression different, yet similar to our own, and the latter a nervous system much the same. In the case of reptiles there is some similarity of nervous structure, but we do not claim to know much about the thoughts and feelings of an alligator, a snake or a frog. Still less does the form and nervous system of insects resemble our own, and we hesitate to infer anything as to the feelings and thoughts of a fly, a beetle, a butterfly or a worm. Still less can we affirm about the mental life of an oyster, and we

may even doubt that a sponge, a coral or an amœba has any consciousness, for they have no brain and no distinct nervous system of any kind.

Again, we ascribe no thought to the rustling leaves and growing grass, or to machines, as we watch the complicated movements of the thrashing machine or the printing press.

From these examples are we not justified in saying that one basis of our belief that other human beings have thoughts and feelings like our own, which they express in a similar way, is their similarity to ourselves, and that the probability of inferences in regard to the thoughts and feelings of men and animals is proportional to the similarity in nervous structure and in history ? This may seem an unsatisfactory basis for psychological inferences, but is it not the same basis as that used in other sciences ?

The probability of the inference that other plants will fade or die, if deprived of sunshine or water, after the same period as the ones tested, will be proportional to their similarity to them in kind, age and condition. Give other illustrations and from other sciences.

The relation of language to such inferences in psychology is worthy of thought and discussion if time permits.

The Three Methods of Studying Psychology. *First* —It is evident that each one can observe his own thoughts and feelings, classify them and determine the relations existing between them. Since in doing this he makes himself the subject of study, we call this the *subjective method.* This is the most direct method that there is, but it presents some difficulties. Try to observe just how you feel when you are very angry or very happy, just how your mind works when you are attending closely to a lesson or trying to understand an explanation. Now state the difficulties that you meet with in trying to make your observations accurately. For similar reasons it is difficult to make experiments and observe results. Even if the observations are accurate, and we correctly determine and classify the relations of the various phenomena of our own mind, it does not follow that they were the same when we were children, or will be when we get old. Nor are we justified in inferring that the phenomena of other minds and the laws governing them are the same as for our own. That the phenomena are not the same may be shown by noticing what comes into your mind when the word "hat" is spoken, and asking others what they think of upon hearing the word. From

what has already been said it is evident that what we find true for our own minds is true for other minds only so far as their inherited organization, history and age are the same.

Second. We may study psychological facts in an indirect manner. We may take the recorded results of subjective study by a number of different individuals, compare them, determine what is common to all and true of ourselves, and what is not. In this way we may find that many things that we thought true for all minds were true for only one or a few, and thus the inaccuracies of the purely subjective method may be corrected. (Very striking illustrations of the truth of this statement may be obtained by inquiring among your friends whether they see certain colors when certain letters or sounds are named, and whether, when they hear numbers, they think of the visual figures in a certain position.)

There is a difficulty in this use of the method, however, due to the fact that the words used may not mean the same. When speaking of external objects we can point them out to another and name them; thus, "this is a chair," "that is a tree," "this movement is walking," etc., but in describing mental states this can not be done so

readily. Thus, "the pain I feel now is an ache," "this mental act is a conception," "that a sensation," means but little to you, for you cannot observe what is in my mind so as to know exactly what I mean, hence there are considerable differences as to the meaning of those words. The classifications of mental phenomena in accordance with the language of the different observers may therefore be very inaccurate.

The *indirect method* may be used with considerable accuracy in other ways, however. If a man says he has a "distinct" mental image of a certain building, or a "fairly distinct" one, or "only a vague" one, he is speaking from the standpoint of his own experience and comparing his mental image of that building with his mental images of other things, and you do not know what his words mean. If, however, you ask him to describe or draw the building, you can judge fairly well as to the distinctness of his mental image. Bearing this in mind, all literature may serve as valuable material for psychological study. Give illustrations.

The indirect method of study may be made still more exact by means of careful experiments. You can find the number of words an individual can

remember after hearing them once by having him repeat them, the number of words he can read in a minute by timing him, the amount of difference in weight, length, color or loudness, between two weights, lines, colors or sounds, by finding what proportion of times he can correctly state the difference, etc. This kind of psychological study, (which is now one of the most promising fields of research in psychology,) is called psychophysics. Can you tell why ? Is a psychological test being made when a pupil is asked to work a certain problem ? Give other examples of tests that may be made the basis for psychological study.

Again, we may study psychology by the indirect method without experiment or the use of language. If we notice what attitude and expression of countenance we assume, or what special movements we make when we experience certain thoughts and feelings we have a basis for inferring the thoughts and feelings of others. Give some examples of psychological inferences of this kind that you have made.

Can you see just why all the ways of studying psychology just described may be called indirect or indirectly subjective ?

Third. There is another method which has been of much use to psychology in the past few years, although some have denied that such study is properly a part of psychology. Both men and animals have nerves, a brain and muscles. Without nerves they would be incapable of receiving sensations of pain, color, sound, or, in short, of being affected in any way by objects. If there were nerves, but no brain to which they might go, feeling and thought would be impossible. Without muscles motion would be impossible, and without motion there could be no expression of thought by language, gestures or change of countenance. The nervous and the muscular system may be looked upon as a very complex machine. Much time has been spent in studying the structure of the nerves and their end organs, the brain, and the muscles and the nerves connecting them with the brain, with the view of determining the function of each and the relation of each to all. Such a study is a part of physiology and may be carried on without any more thought of the thoughts and feelings that accompany the activity of its various parts than the botanist in studying the functions of the different parts of a plant, or a mechanic studying

the workings of a complex machine. While this is true, and one with a good nervous and muscular system may be able to think and act, call all the parts into activity, without any knowledge of the structure of the apparatus with which he works or of the parts employed in each activity, yet it is clear from cases of injured or defective nervous systems, that the perfectness of mental activity is limited by the perfectness of the nervous system, which is the organ of that activity. A comparison of the results of physiological study with the results of psychological study by the other methods, has thrown a great deal of light on many disputed questions, and made our knowledge of others much more definite and precise. This last method gives us the branch of the subject known as physiological psychology.

We have, then, the three ways of studying psychology, the subjective method, in which we observe our own minds, the indirectly subjective, in which we study the mental activities of others from the words they use and the motions they make, and the *objective* method, in which we study the apparatus (brain muscle and nerves,) by which the mental activities are carried on and expressed. Give examples of facts you have gotten in each of these three ways.

DIVISIONS OF PSYCHOLOGY.

The facts of mind are very diverse and it is a part of the work of psychology to simplify the study of mind, by classifying under a common name all similar mental phenomena. The most general and the most universally accepted classification is illustrated by the following example: Entering a book store I see an apparatus, which, after some examination, I perceive to be a dictionary holder. I am very much pleased with the way in which it works, feel a strong desire to own it. After learning the price and considering that in relation to my means and to other things that I wish, I buy it. That act of mind by which I distinguish the dictionary holder from other objects and recognize its value, is an act of *knowing*, an *intellectual* act, a *cognitive* act. The pleasure and desire experienced as I examined it was a *feeling* or *emotion*, an excitation of the *sensibilities*. The resolve to purchase the dictionary holder was a *volition*, an act of the *will*. The powers of the mind are classified as knowing, feeling and willing. In the majority of our mental acts all three of these powers of the mind are exhibited, but usually one is more prominent than the others.

For convenience in studying it, however, the

mind is usually divided into three divisions, the intellect, the sensibilities and the will, and we shall follow that division, remembering all the time, however, that the three powers of the mind are exhibited together in reality, and that we study them separately only that we may not be confused by the multitude of things to be noticed at one time.

Be prepared to give not less than five examples illustrating each of these powers of the mind.

Is there ever cognition without feeling? Can there be feeling without any cognition?

Is will necessary to cognition or to feeling? Does it have any effect upon them? Would will be possible without intellect? Would action be possible? If so, would you call it willing?

Do we ever will without feeling? If we had no sensibilities could or would we ever will to do anything?

CHAPTER II.

GENERAL INTELLECTUAL POWERS.

Consciousness. If one is asleep or has received a severe blow on the head, we say that he is unconscious, which indicates that we know in a general way what is meant by consciousness. One of the distinctions we make between the actions of a man and a machine is that he is conscious of his actions. This consciousness of our own actions, our thoughts and the effects produced upon us by surrounding objects, is the necessary condition of intelligence, feeling and will, but if classified with either division of mind, it should be classified with the intellect. We may look upon it as the elementary or rather the unspecialized form of intelligence, which may assume a variety of forms, both simple and complex, and be intensified in various degrees. Just stop for a little while and note down all of the things of which you are conscious at the present time. Are you ever conscious of what is going on in your own mind and entirely

unconscious of what is going on around you? Are you ever conscious only of the effect outside things are producing upon you?

Is there any difference between having knowledge of a thing and being conscious of it? Illustrate.

Attention—Nature and Limits. When you named the various things of which you were conscious, you found that the sense of sight, of touch and of hearing were being affected all of the time by various surrounding objects, that your bodily condition was affecting it and that various thoughts were flitting through your mind. All of these things were occurring simultaneously, but as you named them was your consciousness of them equally intense, or were you distinctly conscious of one, then of another, as you named them? When you are observing very closely the chair before you, do you not become almost entirely unconscious of all other things that are affecting your senses? This intensification of consciousness upon fewer or but one of the many things that are affecting it, is called attention. It may be to an external object or to a thought in the mind. Attention is quite analogous to the focusing of the eye upon a single object at a time. Indicate as

many points of analogy between the two as you can. Looking upon attention as an intensification of consciousness upon one of the things present to it, it is evident that it may be of all degrees. The minimum degree would be mere consciousness with the slightest possible intensification upon one object, and the maximum consciousness of nothing else but the one object of attention—not even conscious of self and surroundings. Have you ever been attentive in the maximum degree? Have you ever known any one else who was?

Can you attend in a minimum degree to more than one thing at a time? As a help in answering this question, have a friend throw down several similar objects while you attempt to state the number instantly without counting or grouping them. With how many objects can you do this correctly every time? This indicates in a measure how many external things you can attend to at once.

Now, in order to find how many mental processes you can attend to at once, try the following experiments. Repeat a poem and work a simple problem in arithmetic at the same time. Notice whether you attend to both processes at once, or

your attention flits from one to the other. As a further means of determining this question find how long it takes to repeat the poem alone, how long to work the problem alone, then how long to do both at once. In order to make this test fairly it may be necessary to take another problem equally difficult but involving different combinations. For further tests try working a problem mentally while solving another on paper, repeating one poem while writing another, or writing a sentence with one hand, another with the other, while repeating a third or performing an arithmetical operation. In any of the above experiments is there any saving of time by doing two or more things at once? Is there in any of the common tasks?

What kind of acts can best be done at the same time others are being done, new or habitual acts? Can two acts that are similar or two that are different best be performed at the same time, *e. g.*, repeating poem and adding, or repeating one poem and writing another?

Importance of Attention and its Selective Character. Since of all the objects that are affecting our senses and of all the thoughts that are passing through our minds, we can attend in a degree

above the minimum to but very few, it follows that much of what is potentially within the sphere of our mental life is actually almost non-existent. There are individual differences as to the number of things attended to and the intensity of the attention. Would it be safe to say that the amount of knowledge acquired by any individual is directly proportional to the degree and extent of his attention ? Can you trace any analogy between plants and men as to what they take in of their surroundings ? What observations have you made upon pupils showing difference in knowledge corresponding to difference in attention? Which is the more important that a pupil should be supplied with plenty of books and objects for study and should be given good explanations regardless of what his attention might be, or that he should be kept attentive to whatever is presented however little it may be? Which is the most important, that the subject should be presented to a class completely and logically, or that the attention of the class should be secured to whatever is presented?

There are individual differences not only as to the degree of attention and the number of things attended to, but also as to the kind of things

attended to. It is not possible, and probably not desirable to attend to everything affecting us, (Do you think it would be ?) but the question of what kind of things we attend to is a matter of considerable importance. How many of you can tell the number of steps in the stairs or the number of windows in the assembly room ? This illustrates the truth of the statement made above. Give others.

Now, from your own thoughts and observations, give examples of individual differences as to the things attended. Suggestion : notice men of different occupations when observing or reading the same thing. Notice differences between yourself and your companions; between men and women; children and adults, etc. Would it be possible for two individuals surrounded by the same things and thoughts brought up in the same way, to acquire a different stock of knowledge and develop a different character, because of a difference in attention ? Illustrate and give reasons.

Themes for writing : "Importance of Attention." "Individual Differences as to the Things Attended To."

Kinds of Attention. As already indicated, attention may be either to external things or to internal

thoughts. In either case the attention may be with or without effort. If effort is necessary in order to keep the attention upon the object or idea, we say that the attention is voluntary, but if the object or idea by its intensity or peculiarity excites and holds the attention, then we designate it as non-voluntary or involuntary attention. Properly speaking, however, it is involuntary only when it is difficult or impossible to turn it to other things. Give three examples of each of these three kinds of attention in your own experience. What proportion of your attention to the things around you is non-voluntary ? When not studying what proportion of your thoughts are voluntary ? Be ready to indicate what part pleasure and pain, novelty of the thing presented, and natural susceptibility to certain impressions play in non-voluntary attention. Whatever excites attention may be called a stimulus to attention. What is the relation of intensity of stimuli to attention ?

Voluntary Attention. Whenever any effort is made to direct or hold the attention it is to that extent voluntary. Hence voluntary attention may enforce non-voluntary, or it may oppose it, deciding which of two equally attractive objects shall be attended to, or even produce attention to an

unattractive object. Give the best example of strong voluntary attention that you can conceive of. Give the best within your own experience; within your own observation. Give your opinion of the value of the power of voluntary attention. What is the relation between attention and interest? Is voluntary attention ever the result of immediate interest in the thing attended to, or is some derived interest always necessary to voluntary attention? (or in other words, some reason in the way of results why we should attend to the thing in hand.)

How long can you attend continuously to one subject of thought? How long can a child of three, of five, of ten, attend to one thing? Give illustrations, from your observations or reading, of long continued attention to one thing. After you have attended to one thing for a long while do you ever find it difficult to attend to something else? Do people that have the power to attend to one thing for a long while often lack the power to quickly change their attention from one thing to another? Write out your ideal of the kind and power of attention one should possess.

Conditions Favoring and Means of Developing Power of Attention. Non-voluntary and voluntary

attention are very closely related and the latter must be developed out of the former, yet the latter frequently changes after a little time to the former. Do you continue to exercise your will after you become interested in your lesson? The fact that pure voluntary attention can be maintained for but a short time may be illustrated by the following experiment: Find how long you can attend to a simple point or line without thinking of anything else, simply by determining to do so. Now try the same experiment again, asking yourself questions about it—its size, shape, color, distance from other lines or points, etc. In the latter case there is a frequent change in the mental attitude, and this change excites non-voluntary attention, which makes it possible for voluntary attention to be maintained much longer. How long can you get a child to attend to a piece of chalk by simply telling him to study it? How long by asking him questions about it and having him state what he sees. Would this be a safe statement: "No one can attend to one thing for more than a few moments unless the thing itself changes or he changes his mental attitude toward it—thinks of it in a different way or in relation to other things?"

In order to understand more fully what is involved in attending to a thing, make this experiment: Count all of the "m's" on this page; now count all of the "a's". What mental images, if any, were in your mind in these two cases? If present is it possible for you to count rapidly or accurately without them? Why is it, if you are hunting for a lost thing, you want to know how it looks? Is it necessary to have some kind of a mental image of an object in order to attend to it?

Is some knowledge of a subject necessary to attention to it? Have you observed children inattentive because of want of knowledge of the thing being presented?

Referring back to the question of change in mental attitude as necessary to continued attention, is considerable knowledge necessary to change of mental attitude? Notice what knowledge is required to ask many questions about chalk. Is extensive knowledge a favorable condition for attention?

Illustrate the fact that novelty is favorable to attention. Now what is the relation of novelty of the thing presented to a child and his knowledge of something like it, to the degree of interest and attention it secures from him?

Problem: How may the attention of a class be secured, and how may power of attention be developed in children? Which is the easier to attend to, words already written, or words the teacher is writing? pictures or maps that are already drawn, or those being drawn? Why? Which will develop attention most, asking a class such questions as, "What are three times four, three times two," etc., or asking them to tell "What three times each of the following numbers is: three, four," etc.? Why? Can you illustrate any other method of developing voluntary attention? Which is the most favorable to the maintenance of attention, asking a question then calling on a pupil, or calling on a pupil then asking a question? What is the effect of expectancy or a belief that something new or important is about to be presented? How may expectancy be excited?

Topics for writing: "How the attention of a class may be secured," "Means to be used in developing power of voluntary attention in a child who lacks it."

Signs of Attention. Since attention is such an important factor in all learning, it is necessary that a teacher should be able to tell when a child is attentive or, in other words, to interpret the

signs of attention. In studying this, some observations upon yourself will be of value. Relax all of your muscles, then attend intently to something without contracting any of them. Can you do it? Do you think the attitude a pupil assumes has any effect upon his attention?

In your own case what movements, if any, do you make when attending to something in the building to be seen? Something heard? Now attend to some idea in your own mind--perhaps of something you have seen at some distant place or time. Do your movements or feelings differ from those in attending to external things? Is change of attention ever possible without movement?

In the light of these experiments and your observations of others, be prepared to state as specifically as possible just what are the signs by which you can tell when a pupil is attending to what is being presented, and when he is attending to some subject he is reading or thinking about.

CHAPTER III.

SPECIAL INTELLECTUAL POWERS—PRESENTATION.

General Divisions. In studying attention, which we described as the intensification of consciousness, we were obliged to take some account of the feelings and the will—interest being dependent upon feeling and voluntary attention upon will. As we pass from the general to the more special intellectual powers we shall still find a close relation existing between these powers and the feelings and will.

Let us now take an example of mental activity and see if we can classify the intellectual powers exhibited in it. I go to a city I have never visited before, pass through its streets and observe closely all of its buildings. That is, I am cognizant of what is present to my senses. I go home perhaps thinking of other things, but when the name of the city is mentioned there comes up in my mind a mental picture of it just as it appeared when

I was looking at it. That is, I am cognizant of a representation of what has previously been presented. Then perhaps I begin to compare the city with others that I have seen, classify its different buildings, think of their uses, try to determine why it should have so many of one kind, etc. That is, I use my cognitive powers in comparing what is represented with representations of what I have seen at other times and places, *i. e.* I think. We have illustrated by this example three different powers of the mind, (which we shall see later include several others,) viz: *presentative*, or the power to know objects actually present; *representative*, or the power to represent objects previously known but not now present; *thinking*, or the power to compare, classify and reason about things presented and represented. All of these powers may be exercised together, yet they are, to a considerable extent, different. We *perceive* what is present, we *represent* or form a mental image of what is not present, and we *think* about things perceived and represented. Give examples of the exercise of each of these powers.

The faculty or power of the mind exercised in perceiving is called perception and the same word is used to indicate the act of perceiving. The result

of perceiving is called a percept. The power by which we represent what has been previously perceived is called imagination and the same term is applied to the act of representing. The representation itself is called a mental image. Is there any other difference between a percept and a mental image besides the principal one that in one case the object is present and in the other it is not?

Sensation. I hold up this book and you perceive it, but if you had no eyes you would not know of its presence unless I let it fall, and of that you would not be conscious if you were deaf. I place it in your hand and you perceive it, but if, as is sometimes the case, you were unable to feel it, then you could not perceive it in that way. If it had no taste and no odor you could not perceive it unless it should be by the resistance it offered to the movement of your hands. It would be to you as if it were non-existent and the same would be true of every other object. You might represent and think about things you had previously seen, heard, felt, etc., but you could gain no new knowledge. You might know something of your own bodily state, whether sick or well, tired or rested, hungry or satisfied, etc., but nothing could

you know of your surroundings. Your mind might be just as ready for action as ever, but if the sense organs, the eyes, ears and the little nerve endings in the skin, mouth and tongue, were destroyed or the nerves connecting them with the brain were cut, no stimulus from the outside world could reach your brain to call the presentative powers of your mind into action.

Normally, when light falls upon the eye, a nervous impulse passes along the optic nerve, reaches the brain, exciting a certain portion of it to activity, the mind experiences what is called a sensation of light. In a similar way sound waves falling upon the organs of the ear cause a nervous impulse to pass along the auditory nerve, exciting a certain portion of the brain to activity and producing a sensation of sound. Touching the skin, the action of food upon the tongue and of odors upon the olfactory membrane produce nervous impulses that arouse sensations of touch, taste and smell. Movements of any part of the body also produce nervous impulses that result in sensations of movement. Although each of these organs are specially adapted for receiving a certain kind of stimulous, the eye of light, the ear of sound, etc., yet if the optic nerve is stimulated in any way (as

by a jar when one falls, or artifically by electricity,) a sensation of light is produced. So, also, if the auditory nerve is stimulated in any way a sensation of sound is experienced, and so of the other nerves.

Yet a perfect sense organ and a nervous impulse passing to the brain is not all that is necessary to produce a sensation, for if one is unconscious as when asleep no sensation is produced by the sound waves falling upon the ear or a pressure upon the hand. It is the effect produced upon consciousness by the incoming nervous impulses that constitutes a sensation. The effect is, in fact, a feeling, but the intellect cognizes the existence of the feeling and distinguishes it from other feelings. The mere consciousness of the light, the sound or the odor, or the sensation proper, is as much a feeling as a cognition, but the act of distinguishing between the different kinds and degrees of sensation, which is an essential element in perception, is almost wholly an act of the intellect.

The simple sensations given by the special senses are: color and variation in light and shade, by the eye; sounds of different pitch and intensity, by the ear; heat, cold and contact, by the skin; sweet, sour, bitter and salt, by the tongue; a variety

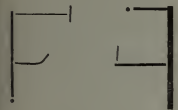
of odors, by the nose, and movement by the muscles and joints.

Besides these special sensations there are certain general sensations coming from various parts of the body, not always definitely located, which give knowledge of bodily conditions, but tell us nothing of the external world, and so are of little intellectual value.

Discrimination. If all objects were exactly alike there would be no chance for the intellect to distinguish between things—we could learn nothing. If the intellect had not the power to distinguish between objects that differ, knowledge would be impossible. The power by which I single out one thing for notice and distinguish it from others, as a book, among a number of other things on a table, is discrimination. If it were exactly like the surface of the table and on a level or continuous with it, I could not single it out for notice, or if it were not, but the light very poor or my vision defective, the same would be true. That is, there must be some discrimination of difference before the object can be singled out for notice, and still further noting of difference before it can be distinguished from other similar objects. The essential element, then, in discrimination is the

power to cognize difference. This implies, also, the cognition of non-difference or similarity.

The singling out for notice is an act of attention brought about by a recognition of a difference. The two processes of singling out for notice or recognition of a difference and that of recognizing the character and amount of difference, may be illustrated by doing both for these two figures.



The first glance shows that they differ, but a longer time is required to note the nature and amount of the differences. Give illustrations from you own experience of ability to tell that two things differ without ability to tell in what way they differ. Also of ability to see difference after it has been pointed out but not before.

It is often noted with surprise that children see resemblances unnoticed by adults, and it is asserted that they see resemblances more quickly than adults. Have you ever noted the fact that strangers see family resemblance more quickly than members of the family? Have you ever met two brothers or sisters that you could scarcely tell apart at first, but after becoming intimately acquainted with them you could see but little resem-

blance? All Indians look alike to one who is not used to seeing them, but not to those who have been much with them. Do these facts throw any light upon the apparent readiness with which children note resemblances? Can you give any farther explanation?

Since the power to recognize difference is such an essential part of all intellectual activity, it has been thought that the smallness of difference that can be detected may serve as a measure of intellectual power. In the branch of psychology known as psycho-physics, a great many experiments have been made upon the discrimination of differences in sensations. Sensations differ in kind or degree. Blue and red differ in kind, light and dark in degree. Give other examples. The experiments have been made mainly with reference to discriminating difference in degree with a view to determining the relation existing between the amount of the difference between the two stimuli or causes of the sensations, and the two sensations that are experienced.

Experiments: Find how much two lines must differ in length in order that you may detect the difference. Try it with both long and short lines. Find how much the height from which a marble

is dropped upon the table must vary in order that you may detect the difference in the intensity of the sound. Find how much two weights must differ in order that you may detect the difference. Try it for both light and heavy weights as for long and short lines, so as to determine whether the difference is a fixed quantity or a ratio. You will thus reach the essential truth of the psychophysical law.

Inferred Differences. Without the power of perceiving differences directly felt, knowledge would be impossible. Without the power of inferring differences not directly felt knowledge would be possible but very difficult of attainment, for a very large proportion of the differences we note are inferred instead of actually cognized. Looking at two biscuit I say that one is better than the other. I discriminate a difference in their visual appearance and infer a difference in their taste. I look at two cubes and say that one is heavier than the other. I discriminate a difference in size and infer a difference in weight. I see that the mercury in the thermometer is lower and I infer that it is colder. Give a half dozen other examples of different kinds of inferred differences and resemblances, indicating what is discriminated and what is inferred.

Perception. Defining perception in the simplest manner possible, we say it is the power of recognizing objects affecting the senses. The process of perceiving ordinarily seems instantaneous, but experiment shows that some time is required, and analysis reveals the fact that it is a very complex process. It is evident that before there can be any perception some sense organ must be stimulated and a sensation experienced, and that the sensation must be discriminated from others, which also means that it must be attended to in some degree at least. I experience a sensation of sound, I attend to it in a slight degree, discriminating it from other sounds that are being made, then I carry the process further, locating it in the adjoining room and finally recognize it as the chirping of a canary. Not until this is done is the process of perceiving complete. In recognizing it as the chirping of a canary I really classify it with a kind of sound with which I am already familiar, of which I have a fairly distinct mental image. There arises also in my mind a visual mental image of the bird producing the sound. Give a parallel example to this, analyzing the perceptive process. In this case the ear is the perceiving sense, but a visual, as well as auditory images, are

called up in the mind before the process of perception is complete. We see, therefore, that though perception is a presentative process, yet without some mental image is called up, without the exercise of the representative power of the mind, the perceptive process is incomplete, for we have not perceived an object until we have recognized it as like some class of objects with which we are familiar, viz, of which we have a mental image.

Let us take an instance in which the eye is the perceiving sense. I distinguish among other objects on the table a spherical colored object, which I perceive to be an apple. In order that I recognize it as an apple I must have a mental image of how an apple looks. Other mental images are also called up of how the apple feels and tastes. Give a parallel example, analyzing the process fully.

Give examples in which touch is the perceiving sense. Taste. Smell. In every case note, if possible, the kind of sensation, the exercise of attention, of discrimination, the location in space, the kind of mental images that were called up.

Give a variety of examples illustrating the fact that there are all degrees of definiteness in percep-

tion. Some can easily be obtained by trying, blindfolded, to identify a number of objects by touch, and noticing just how you perceive what the objects are and how definitely you can classify them.

In ordinary life we do not distinguish all of the characteristics of an object before we recognize it, but we recognize it by some one peculiarity that we have noted, *e. g.* recognizing a voice by a peculiar intonation, a handwriting by a peculiar flourish. Give other examples.

Does a child ever recognize a word by its position instead of its form? Can you give any other example in which a pupil recognizes in a different way from the teacher?

Not only do we recognize objects without noting all of their peculiarities, but it is even necessary in perception to overlook certain appearances of familiar objects in order to recognize them. That is, in the process of perception we not only recognize difference, but we overlook difference in order to perceive the similarity. We become so used to doing this that we do not realize that we do it. A circle seen at an angle really presents the appearance of an elipse, and a square that of an oblong or parallelogram. Yet we have become so accustomed

to thinking of them as they appear when perpendicular to the axis of vision that it is difficult, sometimes impossible, for one who has not studied drawing, to perceive things as they really do appear. Give other examples of things perceived different from what they really appear.

Illusions. In the example given above, where I perceived an apple upon the table and inferred as to how it would feel and taste, perhaps if I were to reach forth my hand, take it and bite it, I should get entirely different sensations of touch and taste from what I expected. It might turn out to be only a painted model of an apple. In this case my supposed perception is only an illusion. Again, I see a stick in the water and perceive that it is bent, but upon putting my hand over the apparently crooked portion, it feels straight. Another illusion. In both cases the sensations given to the perceiving sense are the same as in a true perception, but the inference as to what sensations the objects would give other senses is found false, hence the supposed perception is an illusion. The senses act as they usually do and the mind acts in its habitual way, but the conditions are different and the mind's inference is not verified. Cross the fingers and roll a pea or

large shot in the hand. Explain the tactual illusion thus produced.

Another type of illusion is illustrated by this example. A meadow lark arises in front of a chicken hunter; he thinks it a chicken and fires at once. In this case the mental image of a chicken is already present in his mind, so that an object only slightly resembling it is perceived as a chicken. Habit and expectation will explain most illusions. Give other examples of illusions and state how they may be explained.

Write an essay upon perception, giving your thoughts and observations in regard to the relation of good sense organs, discriminative power, attention, practice and mental images to quick, definite and accurate perceptions.

Apperception. In studying attention we found that what things or characteristics of things any one noticed depended largely upon his previous knowledge and habits of thought. In studying perception we found that every object had to be classed more or less definitely with a group of similar objects with which the individual is already familiar. It would not be an exaggeration to say that in reality we attend to and perceive with all that we have previously attended to

and perceived. This process of noting the characteristics of any object presented to the senses and bringing it into relation with things already known, is called apperception. It is the process of perception carried a little further, so that the object is not only classed with a group of similar objects, but the relation of this thing to various classes of things is noted so that it is brought into relation with all previous knowledge. An important element in both perception and apperception is a calling up in the mind images of similar things. When a new object is presented we immediately begin to think of what we have seen like it, and what that is depends upon our previous experience. As soon as we have classed it we think also of what we know about that class and thus more fully apperceive it.

For examples of apperception recall how different your thoughts of certain places were after you had visited them from what they were before; the different ideas the names of certain subjects called up after you studied those subjects. Recall your earlier experiences as to how new things impressed you. Reflect upon the different meaning a flower has to a botanist or a machine to a mechanic from what they have to the uninformed. Notice how

children are impressed by new things, how they relate them to something familiar, and to them, similar. Notice in recitation how some pupils are better able to understand because of their apperceptive knowledge. Write an essay upon the educational importance of apperception.

DIRECTIONS FOR THE STUDY OF INDIVIDUAL PUPILS.

Study I.—Perception.

I. The Problem is:

1. Why does one pupil perceive more or less perfectly than another?
2. Why some things better than others?

To solve this it should be noted:

1. Whether the pupil manifests superior or inferior perceptive power.
2. What are the causes of this variation from the normal?

Imperfect perception may be due to:

1. A defect of sight or of hearing.
2. A slowness in perceiving.
3. A defect in descriminative power, either in
   a. Inability to note differences or resemblances himself, or
   b. Inability to recognize and estimate them when they are pointed out.

4. A lack of some knowledge that is necessary for apperception.

II. Attention is an important factor in perception. Concerning attention, therefore, it should be observed:

1. Whether defects of eyes or ears or an unfavorable position do or do not prevent the pupil from receiving a strong sensorial stimulous.
2. Whether:
   a. The pupil's attitude is or is not favorable to the maintenance of attention.
   b. The teacher's manner of moving and speaking is or is not calculated to secure attention.
   c. The pupil is or is not fatigued.
3. Whether the previous knowledge, the novelty of the thing presented and the power to relate the two are not lacking when inattention is manifested, and if there is a lack, what it is.
4. Whether the pupil is or is not attentive to the lesson, and if not, to what is he attentive, to his own thoughts or to something without.

In either case how should the diversion from the

lesson be explained? How can the lesson be made more interesting than other things claiming his attention? If the trouble seems to be due to habits of inattention, how may such habits be broken up?

CHAPTER IV.

THE REPRESENTATIVE POWERS OF THE MIND.

Mental Images. The representative power of the mind is shown in its simplest form in the production of mental images. The representative power is good just in proportion as the mental image approaches in vividness the original sense perception. If it is fully as distinct and complete, the two differ only in the fact that in perception the sense organs were affected by the object, while in the forming of the mental image they are not. The nervous process in the brain and the activity of the mind are almost the same. Very rarely, however, is the mental image nearly as distinct as the original impression. How is it in your own case?

Leaving out of account general sensations, how many different kinds of mental images may there be? In your own case which are the most numer-

ous? Which are the most vivid? In trying to answer these questions notice in what way you think of most things; as they look, as they sound, as they taste, etc., and which kind of mental image is the most vivid. There are great individual differences but in the majority of cases the visual images are both more vivid and more numerous, and the auditory and motor next. Test the vividness of your own mental images and of others by presenting an object, then removing it and having it described or imitated.

Can the deaf man form any auditory images or the blind visual if they lost hearing or sight late in life? Can they if they were always deaf or blind? Can you form a mental image of an entirely different kind from anything you have ever perceived?

A mental image may be of a single sensation of a single object, or of a whole landscape, but in either case it is merely a representation of what has been experienced, without change except in vividness and in connection with other objects.

Imagination. This is the typical representative power. The simple mental images of which we have been speaking are the basis of it, and are identical with what is known as *reproductive* imaginative. We may look upon the simple mental

images as the material out of which the imagination may construct new and more complex mental images.

The construction of a mental image out of material already in the mind according to directions or descriptions, is an exercise of the *constructive* imagination. Any modification of the size, shape or color of simple mental images, is an exercise of the constructive imagination; *e. g.* imagine a book ten times as large as this, four times as wide and no thicker and colored blue, or one-sixth as large every way and green.

The representation of any change in the relation of things, as of the furniture in this room, a building turned around or placed on another street, exercises the constructive imagination. Give a description of some building or place you have seen. In doing so you exercise your reproductive imagination. Those who are listening to you form mental images of each of the things as you name them, and exercise their constructive imagination in putting together the simple mental images so as to form the complex image you describe and which they have never seen. Give examples of the use of constructive imagination in reading, in history, in geography.

The child who can represent the appearance of a word with the last letter changed exercises the visual constructive imagination. The one who can sound together two syllables that he has never sounded together, exercises the auditory constructive imagination. The cook who can represent the taste of apples, meat, vinegar, raisins and sugar combined together in certain proportions, exercises the gustatory constructive imagination. Give other illustrations, and illustrations for the other senses.

Write an essay upon the use of constructive imagination in history, reading or geography, or upon means of cultivating it.

There is still a higher form of imagination—the *creative* imagination. If you will draw or write a description of a house or landscape different from any that you have ever seen, you exercise it. Do so. In doing this you will use your reproductive imagination in forming mental images of parts of houses or landscapes, and your constructive imagination in combining them together, but you combine them together in your own way and not according to the directions and descriptions of another. This exercising one's own judgment and taste and ingenuity as to how the elements shall

be combined into the complex mental images is what distinguishes creative from constructive imagination. What kind of imagination does the novelist use? What kind does the reader of the novel use? What kind does a traveler use in his descriptions? What kind do his readers use? What kind does the composer of music use? the artist who paints an ideal scene? the cook who invents new dishes? the child who makes a new design in drawing or writes an ideal story? Give other examples of the creative imagination.

One's imagination is vivid when he can form vivid mental images. With some children the images are so vivid that they have difficulty in distinguishing them from real perceptions, and so may be accused of lying. In other cases the power of forming distinct mental images is lacking and needs cultivation. Find illustrations of these statements.

Some have good reproductive imagination but cannot readily imagine anything different from what they have seen, either with or without direction, as to how it is to be changed, while others readily make such changes, delight in it, and sometimes are so much inclined to use this power that they are almost unable to give true descriptions

of things. Such children delight in fairy tales and day dreams, but the others have more need of such mental exercise.

He who can reproduce accurately has a good reproductive imagination, he who can construct a thing according to description has a good constructive imagination and he who can create an object in accordance with the laws of nature or of good taste (as the inventor and poet,) has a good creative imagination. Give illustrations that you have gained from reading or from observation, of good imagination of each kind.

Theme for writing: "Means of Cultivating the Creative Imagination."

DIRECTIONS FOR THE STUDY OF INDIVIDUAL PUPILS.

Study II.—Imagination. One who can reproduce impressions vividly and can modify and combine them in new ways readily has considerable power of imagination—a power that may either help or hinder him in his studies.

I. If your pupil seems to be imaginative, note:

1. Whether he ever becomes more interested in his own fancies than in his lessons.
2. Whether it ever leads him to perceive or relate things inaccurately.

3. Whether he seems to realize more vividly than others scenes and events described.
4. Whether he remembers better than others what is associated with diagrams and word pictures, and less well what is not.
5. Whether he remembers the picturable part and not the more important truths associated with it.
6. Whether:
   a. He can readily reproduce drawings from memory.
   b. He can draw what is described.
   c. He can make new designs.
7. Whether:
   a. He can readily reproduce narratives and descriptions.
   b. He can write imaginary ones.

II. If he seems to lack imagination, note:
1. Whether he fails to realize scenes and events described.
2. Whether he remembers facts and laws as well or better than descriptions.
3. Whether he understands and remembers what he experiences better than what he has heard about to such an extent that things help him greatly and descriptions scarcely at all.

4. Whether he has diffculty:
   a. In reproducing drawings from memory.
   b. In illustrating descriptions.
   c. In making new designs.
5. Whether he finds it hard to write imaginary descriptions or narratives.

III. In the first case try to determine what methods may best be used:
1. In imparting information.
2. In training the imagination:
   a. To reproduce accurately.
   b. To construct correctly.
   c. To create complex things in accord with the laws of nature or good taste.

IV. In the second case try to discover what methods of instruction will be most effective:
1. In giving him a knowledge of the subject.
2. In developing his reproductive, constructive and creative imagination.

Association and Memory. The fact that an hour after looking at a chair I can form a complete mental image of it indicates that the effect of the original perception remains, or in other words the mind retains the impressions it receives. Without this power of retention, representation, of course,

would be impossible. But something more than retention is necessary to representation. Why did I not form a mental image of the chair, which must have been retained all of the time, before the end of the hour, and why is it that I may not again form a mental image of it for a week, or perhaps never? In this case the mental image of the chair came into my mind at sight of the owner, who had offered it to me an hour before. A mental image of the owner or of his house might have had the same effect. That is, the presentation or representation of something connected or associated with my perception of the chair is necessary to the representation of it. The same is true of all impressions, however perfectly they may be retained. Association is, therefore, a very important factor in our mental operations.

Association. A moment's thought shows us that no impression is received singly, (except it be when the maximum state of attention is reached.) When I look at this book I am conscious, not merely of the book, but to a greater or less extent of the book as on the table, in front of me, in this room, in this building, in this city. Notice in other instances whether this is true in your own case. Consciousness is a unity, and the object of

attention is the central and most vivid portion of that unity. Therefore, when any portion of that unity of experience is reproduced, the rest tends to be reproduced also. The same is true of experiences that occur in immediate succession. Hence the sight or thought of one thing tends to produce mental images of other things seen or thought of at the same place or at the same or nearly the same time. This is called association by contiguity of time or place. Give some examples of such associations in your own case. As a help in getting such examples, have some one pronounce words while you notice what they make you think of, and see how many were associated in time or place.

If the mind were entirely passive what mental images are formed would be determined entirely by the time and place of our experiences. But it is not entirely passive; through the attention it is active, and two things that in ordinary experience would not be presented to the mind at the same place or time, may be thought of together or in immediate succession, and thus become associated so that one tends to recall the other. Illustrate this if you believe it.

The mind has a tendency to act in certain ways

independent of the external order of things. When there is an effect presented the mind at once thinks of the cause, and when a cause it pictures the effect, although but one is perceived at the time. This is called association by cause and effect. Give examples of such associations. Such associations are often identical with those of time. Find some which are not.

There is another still more important and independent of time and place. I saw a gentleman on the street and immediately thought of a friend that I knew five years ago at a place three hundred miles distant. A slight similarity in the two men was the cause of this. This is called association by similarity. Give examples of such associations from your own experience and observations.

The sight of a large horse may make us think of another large horse, or it may make us think of a very small horse, and so we have association by contrast. Give other examples.

Other associations are sometimes given special names, but they are less important and are all some form of association by contiguity. After the first association by cause and effect, or similarity and contrast, the two things thus associated are also associated by contiguity. Illustrate this.

Can you tell what kind of association is present in apperception? What part does association play in ordinary perception?

In learning to read what things must the child learn to associate? Can a teacher determine to any extent the kind of associations a child shall form? If so, how?

In our varied experience things are not associated in pairs, but nearly every one is associated in some way with a great many others. This problem therefore arises. When one thing is presented to or represented by the mind, what is it that determines which one of its many associates shall be called up by it? Notice what is called up by certain objects or certain words and see if you can tell why that particular thing rather than something else came into your mind. Notice in how many cases the explanation may be one of the following: number of times the two have been associated, the intensity of feeling accompanying their association, the recency of the association. Does the general bodily condition or the state of the mind have anything to do with determining what associate shall be called up?

Memory. Memory is sometimes called the reproductive faculty in distinction from imagination,

which is the representative faculty. Memory reproduces what has been produced by the presentative, representative or thinking powers of the mind. It is thus broader in function than the purely representative faculty. It includes association as well as representation and sometimes it is almost wholly of relations rather than of mental images. I have a distinct mental image of three persons to whom I was introduced last night, and of their names, but I do not know to which individuals two of the names belong, and so my memory is at fault though my mental images are perfect. Give other examples of the difference between mental images and memory.

A memory must be of a real experience, while a complex mental image may be formed that corresponds to no definite experience. A memory is always of the past--one's *own* past mental experience (though the incident may have concerned someone else or been read,) and to be a memory in the strict sense of the word, it must be *located* in the past, or, in other words, not only the thing recalled, but also one or more of its associates recalled. Take examples from your own experience and decide whether they are true memories.

To remember, then, implies three things: *retention* of an impression, its *recall* and its *recognition* as a reality connected with other realities in our mental experience.

1. The *retention* of a percept means the retention of one or more of the six different kinds of sense impressions, so we may say that we have six different kinds of memories. Which kind of impressions do you retain best? Have you noticed any one who retained one kind of impression better than another?

Most ideas are represented by words, which are visual or auditory impressions (or if spoken or written also motor impressions.)

Which do you think you can remember best, what you have heard or what you have read? In order to test this, have ten unconnected letters or figures read to you at the rate of one every two seconds, then have them, or better, another similar list, shown to you at the same rate. Find in which case the most are remembered (regardless of order, for that is a question of association.) Repeat the experiment several times. To test the matter further, find how much time, or how many repetitions are necessary to learn a verse of poetry by hearing it read, and the same for a similar verse by reading it silently.

In order to find what influence the motor impressions have, perform the above experiments, either repeating or writing the letters, figures or words.

The general power of the brain to retain impressions varies for different individuals and probably cannot be changed very much by education. The time that any impression will be retained and its distinctness varies with the number of times it has been repeated and the intensity. So far as retention is concerned, then, the improvement of the memory is a question of improving perception, and this largely of improving attention. Give illustrations showing the effect of clear perceptions and concentrated attention upon retention.

2. The *recall* of impressions is largely a matter of association. Illustrate the part, then, that repetition, intensity and recency play in the recall of any thing to be remembered.

By what kind of association can you recall best: time, place, cause, effect, similarity, contrast? Notice, in the case of others, which kind is remembered best.

Do associations with objects, pictures, diagrams or vivid descriptions help you any in recalling?

What have you observed of pupils in this regard?

Is it best to associate a thing to be remembered many times with one thing, or a few times with each of many things? Illustrate and give reasons. You can perhaps get the best illustrations by taking some fact in geography or history.

Associations may be either natural or artificial. They are natural when they make the knowledge gained clearer and bring it into closer relation with that already acquired. Should artificial associations ever be used? Is there any advantage in natural associations aside from the fact that they are sometimes the more helpful in remembering?

State how you would group the following things in your mind if you were required to get them, and why: thread, coffee, gloves, steak, three yards of blue ribbon, tea, two yards of point lace, ten pounds of lard, oatmeal, sausage, bleached muslin. The thread should be white; you are to get two pounds of coffee; the lace must be four inches wide; five pounds of steak and six of oatmeal are wanted; the ribbon is to be $\frac{3}{4}$ in. wide; and of the tea you are to get only $\frac{1}{2}$ lb.; and you must get two pounds of sausage; it is the nine cent muslin that is wanted and you are to get ten yards; the

thread must be No. 36, and the gloves No. 8. Why would you group them so? What general principles of association are illustrated by your method of grouping things to be remembered?

One of the experiments in remembering words, figures or letters should be repeated, noting how many more repetitions are necessary to remember them *in order*, and how much this is helped by grouping them.

This experiment should also be tried: have seven figures or letters read to you until you can repeat them all in order; then have fourteen read in the same way, until you can repeat them in order, (not grouping them,) and see whether they must be read more or less than double the number of times that the seven were. What bearing has this upon increasing the length of a lesson or the amount to be learned at one time?

3. As already indicated, one or more associates of an experience must be recalled or, in other words, it must be *recognized* as belonging with certain other facts, before the act of memory is complete. Example: A student in geography said England has eight times as much commerce as the rest of Europe, and when the statement was questioned, said, "Well, there was something that

was eight times something else, anyway." Give illustrations of recall without recognition. How can the power to recognize where a fact belongs be improved?

The opposite defect is often noticed. A pupil cannot recall a fact, but if another states it he recognizes it at once, and if a mistake is made he knows it. Illustrate this. How may recall at will be improved?

Is a thing recalled best by being seen many times and recalled once, or by being seen once and recalled many times? Which student, other things being equal, will recite best, one who reads a lesson through continuously three times, or the one who reads it once and recalls it twice without looking at the book, except occasionally? What theoretical reason can you give one way or the other? What facts of your own experience?

In voluntary memory attention and will are prominent factors, while in spontaneous recall the laws of association work almost uninfluenced by them. Can you tell just how you voluntarily recall what you wish to recall? You can do this best, perhaps, in recalling a forgotten name. Just how does your will effect the laws of association so as bring into your mind what you want?

Be ready to give examples of individual differences as to power and kind of memory; also differences varying with age.

If you recalled *all* of your mental experiences of the past hour, how long would it take you? Would it be an advantage to remember everything, or is forgetting a condition of a serviceable memory?

Why is it easier to remember certain kinds of facts that you have become used to remembering? If you will tell why it is easier to remember the relation of a certain building to a number of other buildings in a familiar city, than in a strange one, you will have a partial answer to the question.

Write out your ideal of a good memory.

DIRECTIONS FOR THE STUDY OF INDIVIDUAL PUPILS.

Study III.—Memory. In *memory* the problem and the general method of solution is the same as in the stuty of *perception.*

A perfect act of memory requires that we shall retain, recall and recognize previous mental experiences.

I. To *retain* well implies:

a. Intensity.

b. Distinctness of the original impressions.

1. All of the questions asked in regard to perception and attention have a direct bearing upon the retention of the impressions.
2. In addition, we should ask whether:
   a. The number of repetitions was sufficiently great.
   b. The number of things to be remembered were sufficiently few.
   c. What kind of mental images are used.

II. *To recall* implies that:

   a. Impressions have been associated in a certain way.
   b. There has been a certain number of associations.

You should therefore note:

1. Whether the facts recited are associated in the same way in which they are learned or differently.
2. If differently, what kind of association predominates in the recall.
3. Whether the facts are associated:
   a. With the pupil's own experience.
   b. With each other or given hap-hazard.
4. Whether the pupil remembers better:
   a. When one fact of the lesson is made prominent and the others associated with it.

b. When association is made with an object, picture or diagram.

c. When association is made with a vivid word picture.

5. Whether the lessons are remembered best when facts are associated by:

a. Time and place.

b. Cause and effect.

c. Similarity and contrast.

III. *To recognize* that a fact has been learned at a certain time or place or in certain relations with other facts, is necessary to a perfect act of memory. Note:

1. Whether your pupil recognizes where every fact belongs that he recalls.
2. When he is unable to recall a fact, does he recognize it and its relation to other facts when some one else states it.
3. If so, is the inability to recall it because:

a. The question is not asked in a suitable way.

b. The facts have not been associated in such a way as to be recalled at will.

c. He has not practiced recalling them.

4. In any case, what will overcome the defect?

CHAPTER V.

THINKING.

Nature and Divisions. The word horse calls up in your mind some kind of a mental image, it may be of some particular horse, a horse of a certain color but not any particular animal, an image of the general form of a horse, or merely the auditory or visual word horse. Notice what mental images are called up by the words dog, chair, lamp, man and other words.

In any case the word *means* to you, not any particular horse, but a class of animals possessing certain qualities, whatever their color, size or breed. That is, you have a general notion of what is signified by the word horse and represented, perhaps by a mental image of its form and perhaps, also, its size and color. This general notion is called a concept, and the power or process of forming such a general notion is called conception. If you think horses are useful you are forming a judgment in regard to them. If you add that they are therefore valuable you are reasoning. Thinking is a general term used to designate these three processes of conceiving, judging and reasoning. It is specially distin-

guished from the processes we have been studying by being concerned with classes and qualities instead of particular things and sensations. Do you see that this is the case clearly enough to illustrate and explain it?

Conception. Perception and conception are similar and mutually dependent processes. Percepts are the material from which concepts are formed; and yet as we have already found, the process of perceiving is not complete until the thing perceived is referred to a class of similar objects, or in other words, recognized as an individual included in one of our concepts. Suppose a child who had seen but one horse and has learned to recognize it. Now that horse does not present the same appearance to him every time he sees it for it is viewed from different positions, at different distances and perhaps in different attitudes (standing, running, lying down), yet his several percepts of it are sufficiently similar to enable him to recognize it as the same. The mental image of what is common in these percepts and that distinguishes it from any other percepts he may have, enables him to recognize the horse whenever he sees it. Now suppose another horse is brought before him. If it is very

like it he may think it is the same unless the two are shown at once. If they are different and not too dissimilar he will still notice the similarity, and the same tendency to group and identify similar impressions that led him to identify his various percepts of the one animal will cause him to group the two or more similar animals into a class. He thus forms the concept of the group of animals that we designate by the word horse. This concept changes somewhat as the child sees more and different kinds of horses. His concept is enlarged so as to include more individuals, and it is made more definite so that he is not likely to make the mistake which he perhaps made at first of calling a mule, a zebra or possibly a hornless cow a "horse."

Class Concepts. The formation of such a concept as that of a horse has been compared to the making of a composite photograph, and so far as the image portion of the concept is concerned the comparison is fitting. There are certain similarities in all horses, and these having been impressed more frequently than the peculiarities of individual horses may produce a generalized image of the horse. Give examples of other things besides horses of which this might be true, and state as nearly as you can how it *is* in your own case.

If we take the more general concept vertebrate, the generalized mental image that represents this general notion, is rather vague and indefinite. With the concept animal this is still more true, while for such a concept as thing or material there is no mental image that will adequately represent it. Yet in order to form and keep such a general notion in the mind with any degree of definiteness it must be represented in some way. For man a visual or auditory sign known as a word serves as the representative element. Animals not having language are probably unable to form such general notions with any distinctness because they have no words to represent them, while for the less general notions, man, horse, tree, etc., mental images may serve as the representative element.

Degrees of Definiteness of Concepts. In order to form concepts of sufficient definiteness for the practical purpose of distinguishing between the various classes of objects it is merely necessary to discriminate that one class differs from another class. It is not necessary that one shall be able to state the points of difference that distinguish one class from others. Test some children only a few years old and see if they are not in some

cases able to distinguish one class of objects from another readily and to state points of difference only after thought or not at all. Or in your own case you perhaps can readily distinguish a German from a native of this country, but can you tell just in what way they differ? Is a child learning to read ever able to distinguish between two words as wholes but unable to tell in what way they differ? In your own case can you tell the exact difference between the second and the fourth letters of the alphabet and p without looking at them? Give other examples.

Where one can generally distinguish objects of a class from objects of another class, or knows what kind of objects is denoted by a word but is unable to state the qualities that distinguish that class from others his concept may be said to be in the first stage of definiteness. Where he can name one or more of the distinguishing characteristics we may say that his concept is in the second stage of definiteness. If he can name the characteristics common to all of the objects of the class and not possessed by objects of other classes his concept is of the third degree of definiteness or perfect. This is true only when he can give a scientific definition. Of what degree is your

concept tree? Parallelogram? Name three of your concepts of each degree of definiteness.

Extension and Intension of Concepts. Which includes the most things, figure or parallelogram, oblong or square, animal or vertebrate, mammal or horse? Which of each of these has the most distinguishing qualities? Notice in giving a difinition that besides naming the qualities of the class we indicate that it is a member of another class, *e. g.*, a parallelogram is a four-sided plane figure whose opposite sides are parallel. That is to say, it has all the distinguishing characteristics of the figure and three others. In general, what may we say is the relation between the number of things or the *extension* of a general term, and the number of distinguishing qualities or its *intension?* Give illustrations.

In forming concepts something of the same relation between extension and intension may be noted as exists between less and more general classes. For example, a little girl two and one-half years old had seen radishes and learned the name for them. They were red, and when some white ones were placed upon the table she asked what they were. When she understood that they were radishes also, her concept was evi-

dently broadened as to number and variety of things included, but the distinguishing characteristics were for her decreased. Give other examples. Notice that the decrease in the number of characteristics recognized as distinctive means not that the concept is less perfect, but more definite and precise.

Modification of Concepts. All of our concepts that have not reached the third stage of perfectness are subject to change with increased acquisition and experience. Have your concepts been modified by your study of psychology? What ones in what way? Without new experience or special study are concepts ever modified by the way in which we hear or see words used? Illustrate. In what proportion of cases has your knowledge of the meaning of words been gained by direct association with experience? By means of a definition? By the way in which you have heard the words used in connection with words you already understood?

Note this point and illustrate it: to be able to name all the qualities of a class or, in other words, to give a perfect definition, does not mean that the concept is perfect unless the individual is also able to recognize those qualities in the

objects he sees. In which case will it most likely be perfect, where he has learned the definition or where he has made it himself? Which is the more valuable, to be able to give the definition of a prime number or to be able to recognize it instantly? to define a verb or to recognize one? Is a concept perfect until one is able both to recognize and name the qualities that distinguish it? Which do you think should usually be gained first, the power to recognize or to define?

Analysis, Abstraction and Abstract Concepts. I look at the book before me and, disregarding all other qualities, fix my attention upon its color. I look at a flower and notice its color, its shape, the number and position of its stamens, its odor, without thinking of the other qualities when attending to the one. I perhaps compare the color of the flower with that of the book and other objects. Now this singling out for notice one of several qualities or the parts of a whole is analysis, and the thinking of the quality as abstracted from or unconnected with those with which it was perceived is abstraction. After having seen a number of red objects I can form a mental image of the quality redness without thinking of any particular red object. This is an abstract concept. Such an

abstract concept as this, being representable, could be formed without language, while the more abstract concept color would not easily be formed without a word to represent it, and such an one as virtue probably could not be formed with any degree of definiteness without a word to represent it. State which of the following are class and which are abstract concepts: building, liquid, swiftness, number, honesty, machine. Name others of each kind.

Can you remember any difficulty you had when a child in forming abstract concepts, *e. g.*, in determining the meaning of the word "large" by the way people used it? Have you observed any such difficulty in the case of children? In pupils in school, *e. g.*, difficulty in forming a sufficiently distinct concept of divisor, dividend and quotient to clearly understand principles in which those terms are used abstractly? Give other examples from your experience and observations in the school room.

The distinction between class and abstract concepts, the one as of things the other of qualities, is not absolute. Qualities may be designated as belonging to one class of qualities or another and any class concept is abstract in the sense that it is

not individual and concrete—cannot be perceived by the senses. To be able to think of dogs or trees without thinking of any particular dog or tree in any particular place involves abstraction just as much as thinking of white without thinking of any particular white thing.

In forming abstract concepts analysis and abstraction is necessary from the first, but in the early stages of forming class concepts they are not. Could one form concepts of the second stage of definiteness without performing acts of analysis and abstraction? Why?

Classification and Generalization. The formation of concepts is grouping together a class of similar objects or the formation of a class, while perception is the placing of an object in a class already formed, hence both processes involve classification. Since objects possess many qualities, it is evident that after one has formed numerous class and abstract concepts, he can classify an object in various ways, according as one quality or another is taken as the basis of classification. I can classify my pen as an instrument, as a metal, as a pointed thing, as a small thing, etc. Classify a piece of paper in as many different ways as you can; a piece of meat. In these cases you are putting objects in classes already found.

Take a case in which you must, to some extent, form your classes. Classify all the houses in a city in several different ways. Do the same for the things in your room. Notice that in doing so you must analyze sufficiently to note similarities that serve as the basis of classification, and that you must overlook many differences and note certain similarities very carefully. Which is the more difficult to take, a heterogeneous lot of things and decide upon a basis of classifying them, or to put objects in a class the characteristics of which have already been determined? Upon what powers and knowledge does success in each of these processes depend?

I look at a number of script letters and make the general statement that right curves are used in all of them. I find in multiplying a^2 by a^3 that the exponents are added, and make the general statement that in all multiplication of similar quantities the exponents are added. To make these statements I must generalize. The power, then, to detect similarity common to a group of objects or to form a new class with the characteristics observed in one or a few individuals, is generalization. Give examples.

JUDGMENT.

I say that lead is heavy or is a metal, or that this object in my hand is lead. In the first case I assert that a certain quality is characteristic of lead, in the second that the class of things known as lead belongs to the class of things known as metal, and in the third case that this particular object belongs to the class of things called lead. Every one of these statements expresses a judgment in the form of a proposition. All perceiving and all thinking involve judgments, either positive or negative, and if the judgment is explicitly stated it must be in the form of a proposition having a subject and a predicate. In ordinary perceiving and thinking the judgment is made so quickly that we do not realize that there is any such act of the mind, but whenever there is doubt as to the nature of the object perceived, the relation between two classes of objects or as to the qualities of any class, the act of judging is distinctly present. Give examples of distinctly conscious judgments made by yourself and of those that are not.

Basis and Accuracy of Judgments. I look at two lines and say that one is longer than the other. The basis is the percepts of the two lines and the

accuracy depends (1) upon my general power of discriminating differences, (2) upon my special power of visual discrimination, (3) upon the amount of practice I have had in judging the extension of lines of that length in that position. If I say this line is longer than the one I made yesterday, the basis is my percept of one line and my mental image of the other. If I say the line I drew day before yesterday was longer than the one I drew yesterday, the basis is my mental images of the two lines. In these cases upon what does the accuracy depend? Give other examples.

Does feeling ever influence such judgments so as to make them inaccurate? Illustrate.

Give examples in which a particular object, present or not present, is said to belong to a class, samples of which are and are not present, stating the basis of the judgment and upon what its accuracy depends, *e. g.*, this is an oak leaf. Do the same where one class is judged to be included in another class.

What is the basis and what determines the accuracy of judging of qualities, as: this cloth is a bright red; this leaf is parallel veined; this child perceives well; children are restless? We found that differences are frequently inferred, not

directly perceived. Are judgments ever based on inferences? Illustrate.

DIRECTIONS FOR THE STUDY OF INDIVIDUAL PUPILS.

Study IV—Conception. In studying your pupil you should, so far as possible, determine:

1. The origin of his concepts.
2. Their correctness.
3. Their definiteness.
4. The cause of his exceptional ability or inability to form general notions or to identify things as belonging to a general class.

I. Have his ideas been gained:

1. From experience and observation.
2. From hearsay and reading.
3. By study of descriptions or definitions.

II. Note whether:

1. He attaches the right meaning to the word.
2. He gives it too broad a meaning, including too many things because of overlooking some distinguishing quality.
3. His concept is too narrow because he includes qualities that do not belong to some objects properly in the class.

III. Note whether:

1. He understands merely what things are

denoted by the word without being able to tell anything about them.

2. He is able to indicate some of the distinguishing characteristics without being able to define accurately.

3. He can state all of the distinguishing characteristics of the class.

4. He can recognize as well as name the characteristics of the class so as to correctly classify objects in it.

IV. Bearing in mind the results of your study of the above points, and remembering that children classify things with what, to them, they most resemble, note whether in forming general notions:

1. The pupil lacks the power to analyze the particulars so as to discover the essential qualities.

2. He lacks the power to abstract those qualities and think of them independently of any particular example.

3. In either case notice if he is helped by a number of examples of different kinds.

V. In identifying particulars note whether the classification is wrong because:

1. He has had little or no experience with things of that kind.

2. Imperfect knowledge of the basis of classification.
3. Lack of discriminating judgment to distinguish the characteristics and identify them as those of the class.

REASONING.

Let us analyze a few simple judgments in which an assertion as to what is or will be is made not wholly upon the basis of immediate knowledge and perception. I say "if you remove that staging it will fall; if it strikes you it will hurt you." "This rosy, mellow apple is good." In these cases the basis of my judgment must be something more than a perceived relation between my percepts and my mental images, for in the first two cases the judgment is as to the future, not as to what is or has been, and in the third as to a quality I do not directly perceive. This additional basis is the expectation that what has been found true in similar cases will be found true in these. Ordinarily this is a mere matter of association, the present percept calls up a mental image of what was experienced in connection with a similar percept, and though there may be no distinct recall of the past experience, the mental image carries

with it an expectation of reality. If however, we reflect upon the matter, we know that one basis of our judgment is our conception of the general truth that unsupported bodies fall, that heavy bodies produce pain when they strike human beings, that rosy, mellow apples taste good. In all such inferred judgments we *perceive* particular things, conditions or qualities, we *conclude* that certain things are true of them *because* we either implicitly or explicitly recognize a *general truth* in regard to those things, conditions or qualities. If we explicitly recognize this general truth we are reasoning. Our judgment is a reasoned one which may be analyzed into three distinct judgments.

Two Kinds of Reasoning. The reasoning may take two distinct forms. I may say: "All unsupported bodies that I have observed fall; what is true of those I have observed is true of all; therefore all unsupported bodies will fall;" thus arriving at the general truth by a process called induction or inductive reasoning. Again, suppose I know the general truth, then I say: "All unsupported bodies fall; this is an unsupported body, therefore it will fall;" thus arriving at the particular conclusion by a process called deductive

reasoning or deduction. State the other judgments in both the inductive and the deductive form. Give other examples of each form. What is the difference between induction and generalization?

General Truths. There is one general truth which all minds implicitly accept and make the basis of all reasoning. It is that what is true of one thing will be true of what is like it under like conditions. All other general truths known to men have been derived directly from this or gained by induction, The general truths that each individual knows have been gained partly by induction and partly accepted upon authority. In only a comparatively few cases have these inductions been made formally and consciously, but experience has led us to expect certain things under certain conditions or, in other words, to know that things are related in a certain way. Name some general truths that you have accepted upon authority and some you have learned for yourself.

These general truths are often the basis of our judgments without our knowing it, and in reasoning they are often understood without being formally stated and sometimes assumed without knowing it. Can you illustrate this?

In such a statement as this, "Yes, that colt will swim, for I have seen several swim when placed in the water," the reasoning seems to be from particular to particular. There is implied in it, however, the general truth that all colts can swim. There is always a universal element in such inferences only when this universal element is consciously recognized is the conclusion a reasoned one in the strict sense of the word.

Reasoning and Inference. Animals and young children may infer from one particular to another without analyzing to find the basis of inference and the general principle, but this is not reasoning in the true sense of the word. The father of a two-year-old girl blew upon one of two little dolls he had just given her, making a noise. She at once held up the other one for him to blow upon, evidently inferring that if blown upon the same effect would be produced. This was a mere inference based upon experience. In reasoning the complex whole is analyzed and what is found true of objects possessing certain characteristics is said to be true of all objects possessing those characteristics, and that truth is affirmed of any object found to possess such characteristics.

In the above example analysis of the complex

thing, the doll, would show it to be provided with an opening of such a form that when blown upon it always produced a sound, and the induction that all dolls having such an opening would sound when blown upon could be made. Then the second doll would be examined and if the same kind of an opening were found the deduction would be made that this doll, if blown upon, would sound. (In the above instance there was no such opening in the second doll.) Give other examples of inferences by children and animals.

I could infer from experience that upon a cold morning a piece of iron will feel colder than a piece of wood of the same temperature, or I could reach the same conclusion by reasoning in this way: "Of cold bodies, good conductors of heat feel the colder; iron is a better conductor of heat than wood; therefore it will feel the colder."

If the water in a glass pitcher freezes solid, what will be the result? Give a reasoned answer.

Give other examples of inferences and show when they are reasoned, and when they are mere inferences based on experience.

Relation of Analysis and Synthesis to Reasoning. Primarily analysis means separating into parts, and synthesis putting together. Give examples of

mental processes of these two kinds. Since in induction the particular things and conditions must be analyzed in order to determine what ones are the basis of the universal affirmation, that kind of reasoning has been called analytic. In deductive reasoning two things are put together and what is known to be true of one is affirmed of the other, hence that kind of reasoning is often called synthetic.

Inductive reasoning is also called analytic, because we analyze a particular thing and affirm that what we have found true of it will be true of all such things. That is, we have discovered no new truth but merely affirmed as general a portion of what we already knew as particular. In deductive reasoning, however, we are said to arrive at a new truth by bringing the general principle and the particular instance together. This is a logical distinction, however, not a psychological one, for in both cases we reach, what is to us, a new truth.

It is often said, also, that like induction, analysis is going from the particular to the general, and synthesis, like deduction, from the general to the particular. In reality, however, the word analysis should not be applied to reasoning at all. Analysis is necessary in induction, but its function is

ended when a thing is separated into its parts, and the inference that what is true of the thing possessing these characteristics will be true of all things possessing those characteristics, is an induction and, properly speaking, analysis has nothing to do with the reasoning phase of the process. Analysis plays almost as essential a part in deductive reasoning as in inductive, for the object must be analyzed to determine whether it possesses the characteristics of the class, hence calling inductive reasoning analytic reasoning tends only to produce confusion with no corresponding advantage. Compare analysis and synthesis with association and disassociation, pointing out the parallelisms.

To illustrate the inductive method of reasoning and of presenting a subject, let us solve this problem. Find a method of determining the square of the sum of two quantities. Let $a+b$ represent the sum of any two quantities. $(a+b)\times(a+b)=a^2+2ab+b^2$. I analyze the answer and find that I have in it the square of a, the square of b and two times the product of a and b, and that they all have the plus sign. I know this to be the true result for these two quantities and I might find it true for a number of other pairs, and so conclude that it would be true for all others.

I could not be sure of it, however, without some better basis for my conclusion than the fact that it is true in a number of cases. I therefore examine the problem more closely. I see that the first two terms must be multiplied together and that the result will be the square, since they are the same, no matter what the numbers or quantities in the problem are. I perceive the same for the second term. I perceive also that the first term must be multiplied by the second and the second by the first, and hence that I must have, no matter what quantities are used, the square of the first term, the square of the second, the product of the first by the second and the second by the first. I see also that since the sign of both terms is plus, all the quantities of the product will have plus signs. Thus, by analyzing the problem and applying the definitions of the terms and processes and certain general principles already learned about them, I am able to decide with absolute certainty that what has been found true of these two quantities will be true for any and all quantities. If a pupil is led to formulate this general truth by squaring the sum of a number of quantities, he is said to reach it inductively.

On the other hand, if he is given the theorem

and then taught to apply it in a number of different problems, he is said to be taught by the deductive method. In the latter case he must analyze the statement and apply it to the particular problem. Thus: "I have here two quantities, and they are connected by the plus sign, so I have the sum of two quantities, and this is the kind of problem to which the theorem applies. Now the theorem says that I will have the square of the first, that would be a^2; the square of the second, that would be b^2; twice the product of the first by the second, the product would be ab, and twice that would be 2ab; and the signs are all plus so my answer must be $a^2+2ab+b^2$."

Give other examples of the inductive and deductive method of presenting a topic in other studies, analyzing the process in both cases.

The rigidly inductive method is shown to involve almost as much knowledge of definition and general principles as the deductive, and the deductive to require almost as close analysis as the inductive, and so the two kinds of reasoning are very similar and closely related in all inferences.

The inductive reasoning of mathematics is different from that in the natural sciences in this respect. In the first the things and processes are

rigidly defined according to the conceptions the human mind has formed of them, and so are fixed as long as the conception remains the same, while in the second case the characteristics of things are determined by a study of their qualities under various conditions and the nature of natural processes must be discovered by a study of them, hence the certainty of such reasoning is dependent upon the accuracy of the observations and the uniformity of the laws of nature.

Conditions Favoring Success and Accuracy in Reasoning. In our general discussion we found that analysis is one of the important things distinguishing reasoning from mere inferences, and we have just now found that it is necessary to success in both inductive and deductive reasoning. A great number and variety of examples are favorable to the perception of the characteristics and conditions upon which an induction is based, but often a single case thoroughly analyzed gives a more reliable induction than a hundred uncritical observations. In mathematics a single case is generally all that is needed, while in natural sciences there must be enough to determine the truth under all possible conditions and to allow for errors of observation.

We see also that a knowledge of the characteristics of the things being considered, (a clear concept of them, the power to define them scientifically,) and a knowledge of the general truths about them are necessary in reasoning. We may say, then, that the more clear concepts one has and the more general truths with which he is familiar, the greater his power to reason, other things being equal, and his power to reason on any particular subject will depend upon the number and definiteness of his concepts of all things included in and connected with it. Do you know of individuals who are good reasoners upon some subjects and not upon others? If so, does this help to explain such instances?

Will all conditions favoring accuracy of judgment favor accurate reasoning? Why?

Add to the above the power of attention to follow closely a line of thought. and we have the main qualities required in following a chain of reasoning given by another.

To reason independently with success requires all these and more. The most important thing required is the sagacity to seize upon the right characteristic, to conceive of the thing in the right way. We found that things may be classed

in a variety of ways according to the characteristic made the basis of the classification. In the instance of reasoning about wood and iron, they might have been classed in various ways, but only when they were conceived of and classed as conductors of heat could there be any successful reasoning upon the question to be solved. When this was done any one who was familiar with the general truth that iron is a better conductor than wood could readily reach the conclusion. Give other illustrations.

Another power, and one upon which the preceding is partially dependent, is necessary. If, when one thing is presented we had no tendency to think of other things like it, independent reasoning would be impossible, however much knowledge one might have. A tendency to association by similarity is, then, one of the most important conditions of successful independent reasoning. Can you give any observation illustrating this point.

A tendency to associate by similarity, though a necessary condition of reasoning, does not insure accuracy. When the similar thing is called up there must be ability to discern whether the similarity is an essential characteristic about

which some general truth is known. Otherwise analogies may be taken for proofs. Again, one who associates by similarity may note similarities and overlook differences equally important. He is especially apt to omit negative cases, *e. g.*, he observes that it storms when the moon changes but fails to note the cases when it does not. In order to make an accurate induction he must record all cases both positive and negative. Many false opinions upon various subjects are formed because of failure to do this. Scientific men, when they have a theory to prove, often continually find evidence of its truth and none of its falsity. Why?

A tendency to associate by similarity, however, is not even a characteristic peculiar to the reasoning type of mind. It is equally characteristic of the poet. With the poet, however, it is usually a subtle analogy of things as wholes, while with the reasoner it is a similarity in the elements discovered by analysis. Verify this by examining a selection of poetry and one of reasoning.

DIRECTIONS FOR THE STUDY OF INDIVIDUAL PUPILS.

Study V.—Reasoning. The basis of all reasoning is the belief that what is true of one thing is true of another like it under like conditions.

But since things may be like some in one respect and like others in another, the important thing is to know and be able to detect characteristics upon which the reasoning is based.

I. In studying your pupil, notice whether:
   1. He knows what are the essential characteristics.
   2. He knows the general truth about objects having those characteristics.
   3. He has the power to discern the similarity between the particular example and the class about which he knows the general truth.

II. When your pupil is trying to follow the reasoning of another and fails, although he has the necessary knowledge, note whether:
   1. He has sufficient power of attention to keep the various points in mind.
   2. He lacks the power to perceive the similarity assumed or indicated.
   3. He fails though seeing the similarity, to realize its significance because of not recalling the general truth known about things having those characteristics.

III. If the pupil is trying to reason independently about something in regard to which he has sufficient knowledge, note whether:

1. He analyzes the case and seizes upon the right characteristics.
2. He recalls the class of similar objects and the general truth known about them without suggestion from the teacher.

IV. Note whether:

1. There is any marked difference in the pupil's power to follow a course of reasoning and to reason independently.
2. There is any relation between his tendency to associate by similarity and his power to reason independently.

V. Note whether:

1. There is any marked difference between his power to reason inductively—to go from particulars to a general truth—and his power to reason deductively—to apply general truths to a particular case.
2. In inductive reasoning, he needs many or few examples before he is able to get the general truth.
3. In deductive reasoning he is able to apply the general principle to new examples.

HABIT.

I. **Nature of Habit.** Every activity, bodily and mental, besides producing an increase in size or power of the part exercised, results in a tendency to repeat the same or similar acts. This increased power and tendency is the essential element of habit.

If such a tendency were not produced by activities would any education be possible? Give some analogies of habit. State the effect of exercise upon a muscle as regards tearing down and building up. If you conceive of this process as taking place in muscles, nerves and brain in every activity it will help you in the further study of the subject. Note also this point; in the physical analogies of habit there is expenditure of energy and wearing away or removal of materials. Is it so in the physiological and mental sphere ultimately? Does expenditure tend to increase or decrease the power possessed by the organism?

II. **Laws Governing the Formation of Habits.** Determine accurately the relation existing between the (1) number, (2) intensity, (3) regularity, (4) recency of the repetitions of an act to the (1) temporary force, (2) the permanency of the resulting habit.

Which produces the greatest effect, earlier or later repetitions, *e. g.*, the 2d and 3d or the 102d and 103d? Illustrate and give practical applications.

Which is easier, to form a new habit or change an old one? Why? Give practical applications.

III. **Effects of Habits.** Prove by references to principles already learned and by illustrations of your own that habit saves time. Also that it saves energy (1) by a better direction of it, (2) by diminishing conscious voluntary attention.

Show the practical importance of this in both manual and mental labor.

IV. **Habits and Intellectuality.** Is continued intellectual growth possible through the continued repetition of the same acts, *e. g.*, solving the same problem? Why? Refer to principles previously established.

Studies are valuable either in developing mental power or as a means in making further advancement. In which kind of study are the advantages of habit greatest?

May the earlier study of every subject develop mental power and later study make it useful as a means of further acquisition. Give reasons.

Should mental acts ever be made so habitual as to be almost automatic? If so, why? What kind of studies or what portion of studies?

V. Habit and Will. Does habit decrease the number of volitions? Illustrate. To what extent are our acts distinctly voluntary?

Do habits ever prevent the carrying out of volitions? Illustrate.

May habits be a means of increasing will power? Give reasons.

VI. Habits and Morals. Do the laws of growth through exercise discovered for the intellect apply to the feelings? Produce your proof, being very careful that you make the right application of those laws.

What effect does acting contrary to our worse feelings have upon those feelings? Should moral acts become so habitual as to be spontaneous?

VII. Special Habits. Mention a number of personal habits that are valuable, giving the best time for their formation.

What is the relative value to the pupil of the habits he forms and the knowledge he gains? Is it the business of the teacher to pay as much attention to how a pupil learns and expresses himself as to what he learns? Give concrete illustrations and applications.

VIII. Habits and Heredity. Which exercises the greatest influence upon the actions of animals,

the inherited tendencies or those produced by habit? Which those of men?

How is it that in the same surroundings the intellects and characters of people are entirely different? Where they are of the same family how do you explain it, in accordance with the laws of habit? In doing so is it necessary to suppose great individual difference at the beginning?

IX. Questions for Discussion: The Relative Importance of Habits and Ideals in Education.